CLAIMS:

1. A coil array for use in magnetic resonance experiments on a sample to be tested comprising:

a plurality of coil elements tuned to a common frequency for simultaneous parallel reception of signals from a sample to be tested or alternatively in transmission for excitation of a sample to be tested;

the coil elements including a first and a second coil elements each having coil dimensions selected and arranged to provide for the coil elements a predetermined depth from the coil of optimum operation within the sample to be tested;

the first and second coil elements being placed side by side along a longitudinal direction of the sample to be tested so as to define a line transverse to the longitudinal direction which is at the junction between the first and second coil elements;

the coil elements including a third coil element having a first coil section, a second coil section and a third coil section arranged such that:

the first coil section is arranged at a location bridging the transverse line;

the second coil section is arranged at a side of the first coil section remote from said transverse line and the third coil section is arranged at a side of the first coil section remote from said transverse line and opposite to said second coil section;

the first coil section has coil dimensions selected and arranged to provide for the first coil section a depth from the coil of optimum operation within the sample to be tested substantially equal to the predetermined optimum depth of the first and second coil elements;

the second and third coil sections are twisted relative to the first coil section and arranged such that the current therein rotates in direction opposite to that of the first coil section;

the third coil element being dimensioned and arranged such that it is de-coupled from the first and second coil elements.

2. The coil array according to claim 1 wherein the second and

third coil sections are dimensioned in the longitudinal direction such that the sum of the lengths of the first second and third coil sections is substantially equal to the sum of the lengths of the first and second coil elements in the longitudinal direction.

3. The coil array according to claim 1 or 2 wherein the first and second coil elements are spaced in the longitudinal direction so as to improve parallel MRI performance through optimized g-factor.

4. The coil array according to claim 1, 2 or 3 wherein there is provided a further longitudinal coil element having coil dimensions selected and arranged to provide for the further coil element the same predetermined depth from the coil of optimum operation within the sample to be tested, the further coil element being arranged such that the first and further coil elements are placed side by side along a longitudinal direction of the sample to be tested so as to define a line transverse to the longitudinal direction which is at the junction between the first and further coil elements and wherein there is provided an additional bridging coil element having a first coil section, a second coil section and *a third coil section arranged such that:*

the first coil section is arranged at a location bridging the transverse line between the first and further coil elements;

the second coil section is arranged at a side of the first coil section remote from said transverse line and the third coil section is arranged at a side of the first coil section remote from said transverse line and opposite to said second coil section;

the first coil section has coil dimensions selected and arranged to provide for the first coil section a depth from the coil of optimum operation within the sample to be tested substantially equal to the predetermined optimum depth of the first and second coil elements;

the second and third coil sections are twisted relative to the first coil section and arranged such that the current therein rotates in direction opposite to that of the first coil section;

the additional coil element being dimensioned and arranged such that it is de-coupled from the first and further coil elements.

5. The coil array according to claim 1, 2, 3 or 4 wherein there is provided a further transverse coil element having coil dimensions selected and arranged to provide for the further coil element the same predetermined depth from the coil of optimum operation within the sample to be tested, the further transverse coil element being arranged such that the first and further transverse coil elements are placed side by side along a transverse direction of the sample to be tested so as to define a dividing line generally along the longitudinal direction which is at the junction between the first and further coil elements and wherein there is provided an additional bridging coil element having a first coil section, a second coil section and a third coil section arranged such that:

the first coil section is arranged at a location bridging the dividing line;

the second coil section is arranged at a side of the first coil section remote from said dividing line and the third coil section is arranged at a side of the first coil section remote from said dividing line and opposite to said second coil section;

the first coil section has coil dimensions selected and arranged to provide for the first coil section a depth from the coil of optimum operation within the sample to be tested substantially equal to the predetermined optimum depth of the first and second coil elements;

the second and third coil sections are twisted relative to the first coil section and arranged such that the current therein rotates in direction opposite to that of the first coil section;

the additional coil element being dimensioned and arranged such that it is de-coupled from the first and further coil elements.

6. The coil array according to any one of claims 1 to 5 wherein the first and second coil elements are loops

7. The coil array according to any one of claims 1 to 6 wherein the third coil element is stacked on the first and second coil elements so as to have substantially the same width along the transverse line and to be substantially aligned therewith.

8. The coil array according to any one of claims 1 to 7 wherein

the first and second coil elements are each formed from first and second coil sections arranged side by side along the transverse line where the second coil section is twisted relative to the first coil section such that the current therein rotates in direction opposite to that of the first coil section.

9. The coil array according to any one of claims 1 to 8 wherein there are provided fourth and fifth coil elements each stacked on a respective one of the first and second coil elements respectively and each formed from first and second coil sections arranged side by side along the transverse line where the second coil section is twisted relative to the first coil section such that the current therein rotates in direction opposite to that of the first coil section.

10. The coil array according to any one of claims 1 to 9 wherein the third coil element has a fourth coil section, a fifth coil section and a sixth coil section arranged such that:

the fourth coil section is arranged at a location bridging the transverse line and aligned side by side with the first coil section;

the fifth coil section is arranged at a side of the fourth coil section remote from said transverse line and side by side with the second coil section;

the sixth coil section is arranged at a side of the fourth coil section remote from said transverse line and opposite to said fifth coil section and side by side with the third coil section;

the fourth coil section has coil dimensions selected and arranged to provide for the fourth coil section a depth from the coil of optimum operation within the sample to be tested substantially equal to the predetermined optimum depth of the first and second coil elements;

the fifth and sixth coil sections are dimensioned in the longitudinal direction such that the sum of the lengths of the fourth, fifth and sixth coil sections is substantially equal to the sum of the lengths of the first and second coil elements in the longitudinal direction;

the fifth and sixth coil sections are twisted relative to the fourth coil section and arranged such that the current therein rotates in direction opposite to that of the fourth coil section;

the first, second and third coil sections are twisted relative to the fourth, fifth and sixth coil sections such that the current therein rotates in direction opposite to that of the first, second and third coil sections respectively

such that the third coil element is de-coupled from the first and second coil elements.

11. The coil array according to any one of claims 1 to 8 wherein there is provided a fourth coil element;

wherein the fourth coil element has a first coil section, a second coil section and a third coil section arranged such that:

the first coil section is arranged at a location bridging the transverse line;

the second coil section is arranged at a side of the first coil section remote from said transverse line and the third coil section is arranged at a side of the first coil section remote from said transverse line and opposite to said second coil section;

the first coil section has coil dimensions selected and arranged to provide for the first coil section a depth from the coil of optimum operation within the sample to be tested substantially equal to the predetermined optimum depth of the first and second coil elements;

the second and third coil sections are twisted relative to the first coil section and arranged such that the current therein rotates in direction opposite to that of the first coil section;

the third coil element being dimensioned and arranged such that it is de-coupled from the first and second coil elements);

and wherein the fourth coil element has a fourth coil section, a fifth coil section and a sixth coil section arranged such that:

the fourth coil section is arranged at a location bridging the transverse line and aligned side by side with the first coil section;

the fifth coil section is arranged at a side of the fourth coil section remote from said transverse line and side by side with the second coil section;

the sixth coil section is arranged at a side of the fourth coil section remote from said transverse line and opposite to said fifth coil section and side by side with the third coil section;

the fourth coil section has coil dimensions selected and arranged to provide for the fourth coil section a depth from the coil of optimum operation within the sample to be tested substantially equal to the predetermined optimum depth of the first and second coil elements;

the fifth and sixth coil sections are dimensioned in the longitudinal direction such that the sum of the lengths of the fourth, fifth and sixth coil sections is substantially equal to the sum of the lengths of the first and second coil elements in the longitudinal direction;

the fifth and sixth coil sections are twisted relative to the fourth coil section and arranged such that the current therein rotates in direction opposite to that of the fourth coil section;

the first, second and third coil sections are twisted relative to the fourth, fifth and sixth coil sections such that the current therein rotates in direction opposite to that of the first, second and third coil sections respectively

such that the fourth coil element is de-coupled from the first and second and third coil elements.